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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/791,046	03/01/2004	Emmanuel Drege	509982005900	1279

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EXAMINER	
DAVIS, GEORGE B	

ART UNIT	PAPER NUMBER
2129	

DATE MAILED: 05/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/791,046	DREGE ET AL.	
	Examiner	Art Unit	
	George Davis	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-50* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 5-6, 8-20, 22-24, 26, 27, 29-35, 37, 39, 40 and 42-49 are rejected under 35 U.S.C. 102(e) as being anticipated by Doddi et al, U.S. Pat. Pub. No. US 2004/0267397 A1.

As per claim 1, Doddi discloses selecting a profile model for use in examining a structure formed on a semiconductor wafer using optical metrology (see sections 0006 and 0059), obtaining an initial profile model having a set of profile parameters (see section 0026), training a machine learning system using the initial profile model (see section 0006, lines 5-8 and section 0059), generating a simulated diffraction signal for an optimized profile model using the trained machine learning system (see section 0029), wherein the optimized profile model has a set of profile parameters with the same or fewer profile parameters than the initial profile model (see section 0024, last four lines), determining if one or more termination criteria are met (see section 0052, last four lines and section 0057, last four lines), and if the one or more termination

criteria are not met, modifying the optimized profile model and iterating steps c) to e) (see section 0052, last four lines and section 0057, last four lines), wherein the same trained machine learning system is used in iterating step c) (see section 0065, lines 12-14).

As per claim 22, Doddi discloses a computer-readable storage medium containing computer executable instructions for causing a computer (see section 0037) to select a profile model for use in examining a structure formed on a semiconductor wafer using optical metrology (see sections 0006 and 0059), obtaining an initial profile model having a set of profile parameters (see section 0026), training a machine learning system using the initial profile model (see section 0006, lines 5-8 and section 0059), generating a simulated diffraction signal for an optimized profile model using the trained machine learning system (see section 0029), wherein the optimized profile model has a set of profile parameters with the same or fewer profile parameters than the initial profile model (see section 0024, last four lines), determining if one or more termination criteria are met (see section 0052, last four lines and section 0057, last four lines), and if the one or more termination criteria are not met, modifying the optimized profile model and iterating steps c) to e) (see section 0052, last four lines and section 0057, last four lines), wherein the same trained machine learning system is used in iterating step c) (see section 0065, lines 12-14).

As per claim 37, Doddi discloses select a profile model for use in examining a structure formed on a semiconductor wafer using optical metrology (see sections 0006 and 0059), an optical metrology device configured to provide a measured diffraction

signal (see figure 1 and sections 0020 and 0021), a first machine learning system trained using an initial profile model having a set of profile parameters (see section 0006, lines 5-8 and section 0059), the first machine learning system configured to generate a simulated diffraction signal for an optimized profile model having a set of profile parameters with the same or fewer profile parameters than the initial profile model (see section 0024, last four lines), wherein if one or more termination criteria are not met, the optimized profile model is modified (see section 0052, last four lines and section 0057, last four lines) and the first machine learning system generates another simulated diffraction signal (see section 0052).

As per claims 2 and 23, Doddi discloses obtaining a measured diffraction signal from an optical metrology device (se section 0004, lines 1-3) and analyzing the simulated diffraction signal and the measured diffraction signal (see section, 0006, lines 3-6).

As per claims 3 and 24, Doddi discloses the one or more termination criteria includes a cost function value determined based on the analysis of the simulated and measured diffraction signals (see section 0067, lines 1-12).

As per claims 5 and 26, Doddi discloses obtaining a measured diffraction signal from an optical metrology device (see section 0006, lines 1-3) and obtaining a profile associated with the measured diffraction signal (see section 0006, lines 1-6), wherein the one or more termination criteria includes parameter correspondence determined between the profile parameters of the optimized profile model and dimensions of the profile associated with the measured diffraction signal (see section 0006, last five lines).

As per claims 6, 27 and 40, Doddi discloses the one or more termination criteria includes a correlation coefficient determined between a pair of profile parameters of the optimized profile model (correlation coefficient are within the diffraction signals, see section 0052).

As per claims 8 and 29, Doddi discloses selecting at least one profile parameter of the optimized profile model to eliminate or fix to a value (see section 0047), and modifying the optimized profile model before iterating steps c) to e) by eliminating or fixing to a value the at least one profile parameter (see section 0047).

As per claims 9, 30 and 43, Doddi discloses training a first machine learning system using a set of training input data and a set of training output data (see sections 0006 and 0059), wherein each of the training input data is a profile model having a set of profile parameters with the same profile parameters as the initial profile model (see sections 0006 and 0059), and wherein each of the training output data is a diffraction signal (see sections 0006 and 0059).

As per claims 10 and 31, Doddi discloses the set of training output data is generated based on the set of training input data using a modeling technique prior to training the first machine learning system (see section 0059).

As per claim 11, Doddi discloses the modeling technique includes rigorous coupled wave analysis, integral method, Fresnel method, finite analysis, or modal analysis (the structure is analyzed see 0059, line 3).

As per claim 12, Doddi discloses obtaining training input data (see section 0059), generating a diffraction signal with the first machine learning system using the

training input data (see section 0059), determining if one or more termination criteria are met (see section 0052, last four lines and section 0057, last four lines), and if the one or more termination criteria are not met, iterating steps g) to i) (see section 0052, last four lines and section 0057, last four lines).

As per claim 13, Doddi discloses iterating steps g) to i) (), and adjusting the machine learning system or using new training input data in step g) (see section 0052).

As per claims 14 and 32, Doddi discloses testing the first machine learning system using a second machine learning system (see section 0047).

As per claims 15 and 33, Doddi discloses before testing the first machine learning system, training the second machine learning system using the training input data for the first machine learning system as training output data for the second machine learning system (see section 0047) and the training output data for the first machine learning system as training input data for the second machine learning system (see section 0047).

As per claims 16 and 34, Doddi discloses after training the second machine learning system, generating one or more simulated diffraction signals using one or more profile models as inputs to the first machine learning system (see section 0047), generating one or more profile models using the one or more simulated diffraction signals generated by the first machine learning system as inputs to the second machine learning system (see section 0047) and analyzing the one or more profile models generated by the second machine learning system and the one or more profile models used as inputs to the first machine learning system (see sections 0047 and 0048).

As per claims 17 and 46, Doddi discloses the machine learning system is a neural network (see sections 0042 and 0043, line 1).

As per claims 18 and 47, Doddi discloses the optical metrology device is an ellipsometer or reflectometer (see section 0049, line 15).

As per claims 19 and 48, Doddi discloses the one or more profile parameters includes one or more of critical dimension measurements, angle of incidence, n and k values, or pitch (see section 0027, last three lines).

As per claims 20, 35 and 49, Doddi discloses if one or more termination criteria are met, selecting at least one profile parameter of the optimized profile model (see sections 0052 and 0057) and setting the at least one profile parameter to a determined value (see sections 0052 and 0057).

As per claim 39, Doddi discloses a profile associated with the measured diffraction signal is obtained (see section 0006) and wherein the one or more termination criteria includes parameter correspondence determined between the profile parameters of the optimized profile model and dimensions of the profile associated with the measured diffraction signal (see sections 0052 and 0057).

As per claim 42, Doddi discloses the optimized profile model is modified by selecting at least one profile parameter of the optimized profile model to eliminate or fix to a value (see section 0047).

As per claim 44, Doddi discloses a second machine learning system trained using the training input data for the first machine learning system as training output data for the second machine learning system (see section 0047) and the training output data

for the first machine learning system as training input data for the second machine learning system (see section 0047).

As per claim 45, Doddi discloses one or more simulated diffraction signals are generated using one or more profile models as inputs to the first machine learning system (see section 0047), one or more profile models are generated using the one or more simulated diffraction signals generated by the first machine learning system as inputs to the second machine learning system (see section 0047) and the one or more profile models generated by the second machine learning system are compared with the one or more profile models used as inputs to the first machine learning system (see section 0047).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4, 7, 21, 25, 28, 36, 38, 41 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Doddi et al, U.S. Pat. Pub. No. US 2004/0267397 A1 in view of Balasubramanian et al. U.S. Pat. Pub. US 2004/0017575.

As per claims 4, 25 and 38, Doddi does not teach the one or more termination criteria includes a preset goodness of fit (GOF) value determined based on the analysis of the simulated and measured diffraction signals. However, Balasubramanian teaches

the one or more termination criteria includes a preset goodness of fit (GOF) value determined based on the analysis of the simulated and measured diffraction signals (see sections 0045 and 0104). It would have been obvious to one of ordinary skill in the art at the time the invention was made to enhance specifications of the diffraction signal in order to have optimal metrology simulator of the learning machine.

As per claims 7, 28 and 41, Doddi does not teach the one or more termination criteria includes a sensitivity determined for a profile parameter of the optimized profile model. However, Balasubramanian teaches the one or more termination criteria includes a sensitivity determined for a profile parameter of the optimized profile model (see section 0056 and 0093). It would have been obvious to one of ordinary skill in the art at the time the invention was made to enhance specifications of the diffraction signal in order to have optimal metrology simulator of the learning machine.

As per claims 21, 36 and 50, 21, Doddi does not teach the at least one profile parameter includes a thickness parameter, and wherein the determined value includes an average thickness measurement. However, Balasubramanian teaches the at least one profile parameter includes a thickness parameter, and wherein the determined value includes an average thickness measurement (see section 0100). It would have been obvious to one of ordinary skill in the art at the time the invention was made to enhance specifications of the diffraction signal in order to have optimal metrology simulator of the learning machine.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Davis whose telephone number is (571) 272-3683. The examiner can normally be reached on Monday through Friday from 10:00 am to 6:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Vincent, can be reached on (571) 272-3080. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-3800.

April 29, 2006

GEORGE B. DAVIS
PRIMARY PATENT EXAMINER